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PSYCHOLOGY WITHOUT CONSCIOUSNESS.

Behavior: An Introduction to Comparative Psychology. By Prof. J. B. Watson. Pp. xii+439. (New York: H. Holt and Co., 1914.) Price 1.75 dollars.

BY the nature of its subject-matter, psychology has been more handicapped than any other science as regards both methods and aims. This is a truism which may qualify the following statement of Prof. Watson: "Psychology has failed signally during the fifty odd years of its existence as an experimental discipline to make its place in the world as an undisputed natural science." He is quite justified in saying that psychology "as it is generally thought of, has something esoteric in its methods. If you fail to reproduce my findings, it is not due to some fault in your apparatus or the control of your stimuli, but it is due to the fact that your introspection is untrained. . . . If you can't observe 3—9 states of clearness in attention, your introspection is poor. If, on the other hand, a feeling seems reasonably clear to you, your introspection is again faulty. You are experiencing too much." This kind of psychological method has been particularly exploited by the Germans. Again, the science has almost evaporated "in speculative questions concerning the elements of mind, the nature of conscious content (*e.g.*, imageless thought, attitudes and *Bewusstseinslage,* etc.)"; a practical result is that the concept of sensation is "unusable, either for the purpose of analysis or that of synthesis." Generally, the axiom that psychology is a study of the phenomena of consciousness has been thoroughly mischievous; no data have been accorded any importance except in so far as they throw light upon conscious states. Compromises have been attempted; a line has been tentatively drawn where "associative memory" in animals begins; consciousness has been assumed to commence where "reflex and instinctive activities fail properly to conserve the organism," or "whenever we find the presence of diffuse activity which results in habit-formation, we are justified in assuming consciousness." Not the least result of such pre-suppositions is the divorce of the study from practical human interests.

The new school of what Prof. Watson terms "behaviorism" has, as his volume well shows, thrown overboard much conceptual lumber of the sort sketched above, and comparative psychology is able to act untrammelled. "It is possible to write a psychology (as the 'science of behavior') and never go back upon the definition; never to use the terms consciousness, mental states, mind, content, will, imagery, and the like. . . . It can be done in terms of stimulus and response, in terms of habit formation, habit integration, and the like." The starting-point is the observable fact that "organisms, man and animal alike, do adjust themselves to their environment by means of hereditary and habit equipments; . . . . certain stimuli lead the organisms to make the responses." Thus, with the elimination of investigational reference to consciousness, mental state, or imagery (as previously such reference to soul and mind (its successor) had been discredited), the barrier between psychology and objective sciences is removed; "the findings of psychology become the functional correlates of structure and lend themselves to explanation in physico-chemical terms." "The behavior of man and the behavior of animals must be considered on the same plane."

This latest reforming of the comparative psychological front may be considered strategically sound, and should lead to advances along all the line. Little has been accomplished yet, but the resulting clearness of objective is already promising. For instance, Prof. Watson's discussion of the differences between man and animal; convolution of brain surface probably means nothing *per se.* Wundt assumed that the apperception centres resided in the frontal lobe; for this view there is no probability, but since the frontal lobe "was the last brain tissue put on in evolution, and is to be found chiefly in man, we have hastened to assign to its care all those functions in which man is thought chiefly to excel the brute." The break between man and brute is "the lack of well-developed speech mechanisms in animals and the consequent lack of *language habits*. . . . The lack of language habits forever differentiates brute from man."

The general reader and the beginner in comparative psychology will find this impartial and well-reasoned volume invaluable. Some of the best matter is the result of the author's own experiments, *e.g.*, with terns, monkeys, and rodents.

A. E. CRAWLEY.

WATER, SEWAGE, AND FOOD.

(1) *The Chemical Examination of Water, Sewage, Foods, and other Substances.* By J. E. Purvis and T. R. Hodgson. Pp. 228. (Cambridge: At the University Press, 1914.) Price 9*s.* net.

(2) *Water Supplies: their Purification, Filtration, and Sterilisation. A Handbook for the Use of*

Local and Municipal Authorities. By Dr. S. Rideal and Dr. E. K. Rideal. Pp. xii+274. (London: Crosby Lockwood and Son, 1914.) Price 7*s*. 6*d*. net.

THESE two books to some extent supplement one another, the former dealing with the analysis of water (among other things), while the latter treats mainly with the production of a pure and wholesome water supply; the one being designed for the analyst and public-health student, the other for local and municipal authorities.

(1) The volume by Messrs. Purvis and Hodgson, as its name implies, deals primarily with the chemical analysis of water, sewage and foods, and such allied subjects as the detection and estimation of preservatives, and the analysis of air, coal-gas and other gases, rag flock, and urine.

The opening chapter, which is by far the longest in the book, deals with the analysis of water, sewage, and sewage effluents. More or less detailed descriptions are given of the chief tests employed, and in this connection one might note the desirability of the standardisation of some of these tests, notably those for albuminoid ammonia, and oxygen absorbed from permanganate. Some of the tests, as described, do not appear to be capable of any great delicacy. This is particularly the case with the ammonia tests, which apparently are about ten times less delicate than those employed in the laboratories either of the Metropolitan Water Board or the Royal Commission on Sewage Disposal.

At the conclusion of the chapter the results of a series of investigations, chiefly by Mr. Purvis, are given dealing with the effect of mixing sewage with river water and sea water. Much of the work is obviously inspired by the eighth report of the Royal Commission on Sewage Disposal. The researches have resulted in some interesting information, but the manner in which the results are presented makes a full appreciation of them very difficult, and some of the results of an investigation of the changes which occur to a mixture of sewage and sea water in course of time show such wide variations that one is inclined almost to doubt the accuracy of some of the figures; for example, the albuminoid ammonia of a mixture of sewage and sea water analysed after 115, 165, and 176 days is given as 0·078, 0·002, and 0·13 respectively (Table F^1, p. 74).

The remaining chapters of the book consist of instructions for carrying out the analyses of the other substances mentioned above. The instructions are usually remarkably clear and concise, but occasionally they become much involved and even ungrammatical, suggesting that these parts have been hurriedly compiled. This, however, is a small blemish, and can easily be corrected in a future edition; it in no way detracts from a book which will undoubtedly be of great value both to the analyst and the student in a public-health laboratory.

(2) The second volume under review deals with the question of water supply in its widest sense, and only touches on the subject of analysis in the last chapter, and then more on the interpretation of the results than on the way these results are obtained.

The opening chapters deal with the inorganic and organic contents of natural waters, both useful (as in medicinal springs) and harmful (as in water from polluted sources), mention being also made of some of the living contents, particularly those grouped under the name of plankton. Following this preliminary matter, the book deals with the successive stages in water supply under the headings of sources of supply, distribution, storage, filtration, softening, sterilisation, and finally the analysis of water and interpretation of results.

There is so much of interest in this valuable book that it is difficult, in the space allotted, to more than mention many of the important subjects dealt with, but several points call for especial notice.

The chapter devoted to storage is full of interesting information, particularly with regard to the physical, chemical, and bacteriological changes which occur in water subjected to storage. It is pointed out, for instance, that while the changes which occur to an initially impure water are wholly or mainly in the direction of improvement, an initially pure water may considerably deteriorate owing to prolonged storage.

Before going into the important subject of filtration, the authors devote a chapter to preliminary purification, including precipitation and assisted sedimentation, deferrisation, and the abatement of nuisances arising from living growths in the reservoirs; this subject is treated very fully, and reference is made to the work of many investigators both English and foreign.

Chapters vii. and viii. deal in great detail with the question of sand filtration and mechanical filtration, chapter ix. with softening, and then follow two important chapters on sterilisation.

The authors enter a strong plea for the sterilisation of all supplies from polluted or pollutable sources. Against the contention that the expense of sterilising is prohibitive in a great many cases, the suggestion is put forward that there might be a dual supply for drinking and non-potable purposes, but the arguments in favour of this course do not seem to be very convincing; moreover, the alternative to sterilisation put forward by Dr. Houston in his reports to the Metropolitan Water Board—namely, adequate storage followed by efficient filtration—is not presented in its best light, and one is inclined to think a much better case could be made out from Dr. Houston's reports in favour of his suggestions than is conveyed by the somewhat meagre extracts given in the book.

The different means of sterilising water are very fully described and discussed, both chemical (peroxides, excess lime, chlorine, and hypochlorites, etc.), and physical and electrical (electrolytic hypochlorite, ozone, and ultra-violet light), and full reference is made to the places where these processes are practised.

The concluding chapter, on the analysis of water and the interpretation of results, is written more for the water authority than the analyst. It is not an easy subject to deal with, yet the authors appear to have done it very carefully.

There are numerous excellent plates in the book illustrating different works and processes.

DENISON B. BYLES.

RADIOLOGY IN THEORY AND PRACTICE.

(1) *X-rays: an Introduction to the Study of Röntgen Rays.* By Dr. G. W. C. Kaye. Pp. x+252. (London: Longmans, Green and Co., 1914.) Price 5*s.* net.

(2) *A Manual of X-Ray Technic.* By Capt. A. C. Christie. Pp. viii+104. (Philadelphia and London: J. B. Lippincott Company, n.d.) Price 8*s.* 6*d.* net.

(3) *Molecular Physics.* By J. A. Crowther. Pp. viii+167. (London: J. and A. Churchill, 1914.) Price 3*s.* 6*d.* net.

(1) THE discovery of X-rays has hitherto afforded an opportunity, probably unique in the history of science, for the production of that kind of literature which is distinguished more for its sensational character than for its accuracy or usefulness. If the numerous small books and pamphlets dealing with the subject and published between 1895 and 1898 do not seem to us now to possess any striking feature, they are at least remarkable for their resemblance to one another. They serve, too, as a measure of the wide popular interest aroused by Prof. Röntgen's work. Some of these publications actually reached the six thousandth edition before finally sinking into oblivion. When it was realised, however, that X-rays, in conjunction with the study of radioactivity, were destined to play a vital part in the elucidation of many problems hitherto considered insoluble, and a few well-known laboratories had successfully taken the matter in hand, the budding heralds of a new physics seem to have lost their spirit. It is noteworthy that from about 1898 until now, excepting some medical works, including an account of radiation treatment, no English book has appeared devoted solely to the systematic study of Röntgen radiation.

Dr. Kaye's book will therefore be welcomed by all who are engaged in work with the new radiations generally and with X-rays in particular, for it has appeared at the very moment when it is most needed.

The time has certainly come to take stock of our knowledge of this subject and to set forth clearly the relationship which connects the speed of the electron with the wave-length of the radiation resulting from its impact against a specific substance. Incidentally, it is seen that the production of a radiation identical with the gamma rays from radium is merely a question of overcoming certain experimental difficulties, and obstacles of this character generally disappear with the lapse of time. The first part of Dr. Kaye's book deals in an interesting manner with some of the early classical vacuum-tube experiments, and care is taken, by the aid of numerous asides in the form of footnotes, to give the reader many useful facts as well as references.

The fourth chapter deals with the X-ray bulb itself, and the progressive changes in its design are traced from the 1895 type, with flat electrodes, up to the somewhat elaborate modern apparatus. There are many excellent illustrations here, and the photomicrograph on p. 43, of an anti-kathode after prolonged use, is of great interest. A chapter follows in which the various high-potential generators of electricity are described. The references to influence machines, induction coils, and step-up transformers contain many practical hints, and the oscillograph records are well reproduced. Next follows an account of the various interrupters and their several virtues or drawbacks, and a chapter dealing with the actual manipulation of an X-ray apparatus, wherein we are told about the volatilisation of the anti-kathode, the coloration of the glass, and so forth—all of great practical interest and importance to these engaged upon this work. The rest of the book is concerned with the more theoretical part of the subject and methods of measurement, questions of wave-length, sparking potentials, absorption coefficients, and so on. The work of Barkla and others on the secondary and characteristic radiations are fully set out, so that the reader may be gradually prepared for the final sections dealing with the actual nature of X-rays and the